each waiting for the other to raise its bid and reactivate both. This problem is mitigated by allowing a bidder to increase its own bid, even when the increase is not sufficient to make the bid active.

Furthermore, a less-than-fully-efficient allocation of blocks across BTAs might result from the use of this procedure. Better would be a procedure which allowed for bidding on all subsets of BTAs and license blocks, but the complexity of the informational feedback from such a procedure is substantial. Hence, the procedure offered here should be viewed as a compromise, likely to lead to a nearly-efficient outcome, while remaining quite practical.

| | BTA 1 | | | BTA 2 | | | BTA 3 | | | BTA 4 | | | BTA 5 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | * | $xx | id# | | $xx | id# | * | $xx | id# | * | $xx | id# | * | $xx | id# |
| D | * | $xx | id# | | $xx | id# | * | $xx | id# | * | $xx | id# | * | $xx | id# |
| CD | | $xx | id# | * | $xx | id# | | $xx | id# | | $xx | id# | | $xx | id# |

| | BTA 6 | | | BTA 7 | | | BTA 8 | | | BTA 9 | | | BTA 10 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | * | $xx | id# | * | $xx | id# | | $xx | id# | * | $xx | id# | | $xx | id# |
| D | * | $xx | id# | * | $xx | id# | | $xx | id# | * | $xx | id# | | $xx | id# |
| CD | | $xx | id# | | $xx | id# | * | $xx | id# | | $xx | id# | * | $xx | id# |

time since last change in active bid : m:ss

In this display, the block-C and block-D licenses in 10 BTAs are being sold. For each BTA, the current high bid and the identity of the current high bidder are displayed for block C, block D, and the combination of blocks C and D. ($xx represents a displayed bid, and id# represents a publicly-known bidder identification number. The asterisks indicate the currently-active bids, i.e., they truly are "asterisks".)

If the total of the bids for blocks C and D separately exceed the bid for the combination of block C and D, asterisks appear next to the two individual bids; otherwise, an asterisk appears next to the combined bid. Bidders are allowed to raise their own bids, if those bids are high and inactive; they are also allowed to withdraw inactive bids (making the previous high bid the new high-and-inactive bid).

A running time-counter at the bottom of the display indicates the length of time that has passed since the last change in active bids, i.e., since the last time the total of the potential winning bids was increased. When the time-counter reaches a prespecified value, the auction is over.

## 6. Proposal for the auctioning of block E, F, and G licenses

We propose that the same "two-dimensional" procedure be used here as was proposed for the sale of the C and D blocks. The only change is that more possibilities for aggregation of blocks within a BTA now exist. Two levels of detail are worthy of consideration. At the greater level of detail, all seven subsets (E, F, G, EF, EG, FG, and EFG) can be listed for each BTA. Alternatively, only four subsets can be listed (E, F, G, and EFG); this simplifies the display, but requires that applicants seeking precisely two of the 10 MHz blocks bid for two individual licenses.

All other considerations are the same as those discussed in the previous section.

## 7. Auction scheduling

A leisurely schedule would allocate three weeks to the sale of MTA-wide licenses. This would include several days for consideration after the announcement of nationwide bids (if such bids are allowed), and then the sale of block-A and block-B licenses covering four MTAs (i.e., four successive simultaneous-ascending-bid auctions) each day. The sale of block-C and block-B licenses in MTA-sized groupings of BTAs would take at most five weeks (if only two MTAs were covered each day), and the sale of the block-E-through-G licenses would take a similar length of time. In total, the entire allocation process could be completed in no more than three months.

A doubling of this pace might well be possible. This would cut the total time requirement for the allocation of all PCS licenses to a mere six weeks. (However, the slower schedule would allow applicants more time to develop (and modify) their acquisition strategies, and therefore would be likely to yield a somewhat more efficient final allocation of licenses.)

## 8. Concluding comments

The FCC will soon embark into uncharted waters, as it organizes one of the largest and most complex auctions ever conducted. The voyage will be exciting, and new precedents will be set at each stage of the trip. With a well-chosen approach, the public interest will be served (and, not incidentally, the public treasury will be enhanced).

In this paper, it is reasoned that the offering of nationwide PCS licenses is unnecessary in order to achieve an efficient allocation of licenses, is unlikely to be value-maximizing, and involves dangers in the development of licenses and provision of service to consumers.

The specific proposals of auction procedures presented herein were chosen in order to maximize the efficiency of the final allocation of licenses, and to generate fair market prices for the licenses, while still remaining within the realm of practicability. Other approaches may well be feasible. However, it is strongly recommended that the following issues be kept in the forefront: The procedures finally adopted should be likely to yield an efficient outcome, while at the same time not requiring bidders to engage in overly-complex strategic analysis and not subjecting them to an unassimilatable overload of information at any stage.

## 9. Author's biography

Robert J. Weber holds the position of Professor of Managerial Economics and Decision Sciences at the J.L. Kellogg Graduate School of Management, Northwestern University. Educated at Princeton (A.B.) and Cornell (M.S., Ph.D.), he was a faculty member of the Cowles Foundation for Research in Economics at Yale prior to joining the Kellogg faculty in 1979. His research generally concerns strategic aspects of economic competition, with primary focuses on auctions and electoral processes. He is the author of more than 40 research papers and has served as a consultant to a variety of private and public institutions.

On the academic side, Professor Weber is co-author of the seminal paper, "A Theory of Auctions and Competitive Bidding" (*Econometrica* 50, 1981), and has published several subsequent articles on the auctioning of multiple items. On the more practical side, in the mid 1980s Professor Weber served as the external consultant on auction theory on the project (sponsored by the Department of the Interior) which developed the methods used to schedule area-wide auctions of petroleum extraction leases on the U.S. outer continental shelf. In June of 1992, he organized (with representatives of the Federal Reserve Board and the Department of the Treasury) and gave the opening address at the public forum which led to the currently-ongoing experiment in the use of uniform-price auctions to place the Treasury's 2-year and 5-year debt issues.